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Properties of Ionic and Covalent Substances Lab

Introduction:

Atoms will form bonds with other atoms in an attempt to obtain a stable valence electron shell. To obtain a stable valence shell atoms can either gain or lose electrons or share electrons.

Ionic Compounds: If an atom gains electrons it forms a negative ion (anion), and if it loses electrons it forms a positive ion (cation). Negative and positive ions attract each other and form "ionic bonds". Ionic bonds form between metals and nonmetals when electrons are transferred. All ionic compounds have a solid crystalline lattice structure.

Covalent Compounds: Atoms can share electron pairs when their orbitals overlap to form single, double, or triple covalent bonds. Covalent bonds are formed when nonmetals bond to nonmetals. Covalently bonded atoms form molecules. These molecules can exist as solids, liquids, or gases.

These molecules can be polar or non-polar depending on their shape and the distribution of charge within the molecule.

Purpose: In this lab we will examine certain physical properties of three compounds to try to determine if they are ionic or covalent, and if they are covalent if they are polar or non-polar.

Materials:

| | | |
|---------------|---------------------|---------------------|
| Table Salt | Aluminum foil | Three 100mL beakers |
| Sugar | Deionized water | Stirring rods |
| Wax | Conductivity tester | Crucible tongs |
| Bunsen burner | | Spatula |

Safety: Safety Goggles! Carefully follow all instructions, both written and oral. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.

Procedure: Part 1: Test of Melting Point

Generally, ionic solids have very high melting point temperatures. Covalent molecules have a lower melting point. Polar covalent molecules have a higher melting point than non-polar covalent molecules.

1. Mold an aluminum foil boat that will serve as a tray for the table salt, sugar, wax.
2. At different corners of the boat place a very small amount of each substance.
 - a. Table Salt
 - b. Sugar
 - c. Wax (from teacher)
3. Set the burner on medium flame.
4. Observe and record the *order* of melting of the solids in your data table (1, 2, 3)

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5. After observations are complete, **Carefully** remove the aluminum foil boat with **crucible tongs** and allow it to cool completely. Dispose of the boat in the garbage.

Part 2: Test of Solubility

Generally, ionic solids are only soluble in very polar solvents (such as water). Polar covalent molecules will dissolve in polar solvents and non-polar covalent molecules will only dissolve in non-polar solvents ("like dissolves like").

1. Test the solubility of each of the three solids by placing a "scoop" of each solid in a 100mL labeled beaker and filling it half way with de-ionized water. (Avoid cross contamination in beakers!)

2. Stir the mixture and observe and record if the solid dissolved in the water. (Do Not Dump It Out!)

Part 3: Test of Conductivity

When an ionic compound dissolves, the ions are often pulled apart by the polar water and become free to move about in the solvent. The movement of these charged ion particles allows for the conduction of an electric current. Un-dissolved solids or polar covalent solids do not form these ions in water and thus do not allow for conduction.

1. Insert the metal electrodes of your conductivity tested into each of the three mixtures you created in the 100mL beakers. Use a paper towel to clean the leads to avoid cross contamination between tests.

2. Observe and record if conductivity was detected in each solution. A positive result is indicated by a steady green light.

Data Table

| Compound | Order of Melting | Soluble in water? | Soluble in hexane? | Conducts in water? |
|----------|------------------|-------------------|--------------------|--------------------|
| Sugar | | | | |
| Salt | | | | |
| Wax | | | | |

Conclusion, complete sentences:

Based upon your observations, place each substance into one of the following categories: ionic compound, polar covalent compound, or non-polar covalent compound. Based on the data given for the solubility in hexane, is hexane a polar or non-polar covalent solvent? Explain using evidence from your experiment only.

Discussion, complete sentences:

Discuss the reasons why you placed each substance in its category. Provide evidence from the melting point, solubility, and conductivity tests you did in the lab.

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